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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

Mr. William Caton  
Acting Secretary  
Federal Communications Commission  
1919 M Street, NW, Room 222  
Washington, DC 20054

Re: **Ex Parte Presentation in Gen. Dkt. 90-314  
(Amendment of the Commission's Rules to  
Establish New Personal Communications  
Services)**

Dear Mr. Caton:

Pursuant to Section 1.1206(a)(2) of the Commission's Rules, I am transmitting an original and one copy of the enclosed written ex parte communication being delivered today.

Should any question arise concerning this matter, please contact me.

Sincerely,

*David E. Hilliard*  
David E. Hilliard  
Attorney for Motorola, Inc.

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Encl.

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September 30, 1994

**VIA Federal Express**

Mr. Julius Knapp  
Chief, Authorization & Evaluation Division  
Office of Engineering and Technology  
Federal Communications Commission  
7435 Oakland Mills Road  
Columbia, MD 21046

Dear Mr. Knapp:

As you know, Motorola has remained keenly interested in the development of the technical standards for PCS services as adopted in the FCC's Gen. Docket No. 90-314. Most recently, Motorola has responded to petitions for reconsideration or clarification of the FCC's Memorandum Opinion and Order released on June 13th, 1994. Specifically, Motorola filed comments addressing the petition for reconsideration filed by Omnipoint Corporation as it relates to the proper measurement procedures for out-of-band emissions caused by licensed PCS transmissions. In this letter, Motorola further addresses the issues associated with measuring out-of-band emissions and relates certain necessary assumptions and interpretations to the rules already adopted. Motorola's purpose is to ensure that the rules adequately further the Commission policy of remaining neutral with respect to PCS technology. In this regard, Motorola expects that Broadband PCS will be characterized by greater variety in the modulation, access systems, and bandwidths employed than in narrowband PCS. In addition, Motorola takes this opportunity to discuss a clarification of the provisions of Section 15.323(c)(6) relating to the spectrum access requirements for unlicensed PCS devices.

**LICENSED PCS**

**Effective Radiated Power vs. Output Power: Measuring Out-of-Band Emissions**

In Paragraph 200 of its MO&O, the FCC stated that the spurious emissions regulations "apply to both the transmitter, as tested during type acceptance, and the operating

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system, as installed by the licensee." For this reason, the FCC indicated that it would add a rule to require that licensees attenuate emissions beyond the standards should interference occur to other users of the spectrum.

Motorola is concerned that these statements may be interpreted to require manufacturers to consider the maximum permitted effective radiated power of a communications system when measuring the spurious emissions of a transmitter as part of the equipment authorization process. Emissions beyond the PCS channel edge are to be attenuated by the formula  $43 \text{ plus } 10 \log_{10} (P)$ . The text of the Commission's MO&O could be interpreted as requiring use of ERP instead of transmitter output power in defining the required attenuation. Since ERP may be 20-30 dB higher than transmitter output power in many PCS systems, manufacturers will be severely disadvantaged in designing spectrum efficient technology at low cost.

Such an interpretation is not consistent with past practices in other land mobile services. The cellular radio service, for example, is bound by the same attenuation schedule, but Section 22.907 clearly indicates that "P" represents the mean output power of the transmitter. To require PCS technology to assume a 20-30 dB penalty compared to cellular will further increase costs to the end-user, either through increased product cost and/or through the increased extent of displacement of channels from the edge of the blocks, thereby reducing an operator's capacity and efficiency.

Therefore, after significant consideration, Motorola asks the Commission to clarify its intent so that PCS manufacturers can rely upon past FCC practices and design equipment that satisfies the required  $43 \text{ plus } 10 \log_{10} (P)$  equation where P represents the mean output power of the transmitter.

#### **Measurement of Out-of-Band Emissions**

As modified by an Erratum released July 22, 1994, Section 24.238(a) requires that compliance with the out-of-band emission standards must be demonstrated using measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. As indicated in comments filed on August 30th, Motorola believes that this wide bandwidth will result in inaccurate representations of out-of-band emissions. Furthermore, Motorola now points out that relying upon a measurement device's "resolution bandwidth" alone is insufficient to accomplish the goal of ensuring accurate and reliable measurements. Different measurement devices having the same resolution bandwidth could have different selectivity performance. When measuring emissions close to the PCS channel, the energy within the occupied bandwidth of the channel can have a strong influence on the measurement due to less than ideal selectivity of the measuring instrument. As a result, even with an unmodulated carrier

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frequency separation (at least several MHz) between the measurement "window" and the PCS carrier in order to "show" the required attenuation. Interpreting these measurements as "out-of-band emissions" is obviously a significant distortion.

To clarify this issue, Motorola supports an interpretation of the "1 MHz resolution bandwidth" requirement as describing a "brick-wall" filter (infinitely sharp selectivity skirts). This filter can be simulated by using a relatively narrow "resolution bandwidth" setting on a spectrum analyzer (approximately 1 percent or less of the measurement bandwidth) and integrating the total emissions power over the measurement bandwidth. Most modern spectrum analyzers have the capability to accomplish this automatically.

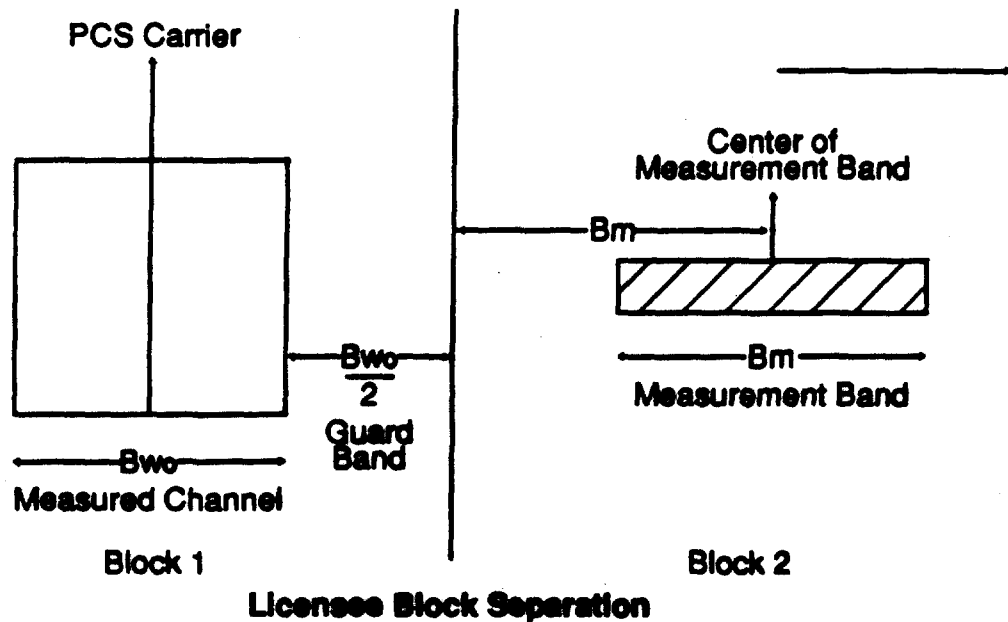
Therefore, in the first instance, Motorola recommends that to avoid measurement confusion, the term "resolution" be dropped from 24.238(a) and that an endnote be added to identify that the above recommended approach is an acceptable interpretation of the measurement requirement.

### **Band Edge Displacement**

Section 24.238(a) states that the "[n]ominal carrier frequency shall be adjusted as close to the licensee's frequency block edge as the design permits." In most cases the out-of-band emissions requirements will dictate how close this can be.

However, the emissions specification embraces a one-sided measurement approach while the inter-system interference protection objective is, in fact, two-sided. In other words, the measurement procedures necessitate that a "displacement" be created on one side of the dividing line to protect adjacent channel blocks but does not recognize that the same type of displacement would result on the other side. This would lead to overprotection since it would effectively require a displacement larger than necessary. Thus, the measurement in one block appears to ignore the fact that the licensee in the adjacent block would not have a channel, edge directly contiguous to the edge of the block adjacent.

The width of this displacement is a function of the occupied bandwidth which is a function of the modulation employed, and, following the logic expressed above, should be one half of the occupied bandwidth for each side of the band edge. The interference to any given system can then be determined by measuring the interference in that system's bandwidth "B", with the center of the measurement band spaced at B from the band edge.



In order to protect a range of different bandwidth technologies, while not penalizing any of the wider band technologies, we propose the above modification to the fixed 1 MHz bandwidth. The rule clarification set forth above can be summarized in the following table, which shows the measurement bandwidths which would be employed in demonstrating compliance:

Measurement Bandwidth	Displacement From Band Edge to Center of Measurement Band	Total Allowed Power
10 kHz	10 kHz	-43 dBW
30 kHz	30 kHz	-43 dBW
100 kHz	100 kHz	-43 dBW
300 kHz	300 kHz	-43 dBW
1 MHz	$\geq 1$ MHz	-43 dBW

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Of course, the measurements would be conducted as described above, i.e., using a spectrum analyzer set with its resolution bandwidth to approximately one percent of the measurement bandwidth with emissions power integrated over the measurement bandwidth. The key feature to this interpretation of the measurement procedures is that it will reduce the tacit discouragement of wideband technologies such as CDMA from the Commission's rules by recognizing that appropriate dual displacements will be required, while simultaneously insuring protection of any system. The Commission's objective of 43 plus  $10 \log_{10}(P)$  in decibels (i.e. -43dbw) is maintained, with manufacturers required to demonstrate compliance at all of the multiple points indicated in the table. In this way, systems using different types of modulation in adjacent blocks will both be protected from each other.

In summary, Motorola proposes that Section 24.238(a) be amended to read as follows:

On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the mean transmitter output power (P) by at least 43 plus  $10 \log_{10}(P)$  decibels ~~or 80 decibels, whichever is the lesser attenuation.~~ Compliance with this provision is based on the use of measurements instrumentation employing a resolution bandwidth of 1 MHz or greater equal to the displacement from the licensee's frequency block, up to one MHz maximum. An acceptable measurement technique is to use a spectrum analyzer with its resolution bandwidth set to 1% or less of the measurement bandwidth, integrating the total emissions power across the required measurement bandwidth.  
Nominal...<sup>1</sup>

Such a modification of the rules will not increase the likelihood of actual interference and will ensure that manufacturers will be able to provide cost-effective technology. Unless changes to address the problem discussed herein are made, the practical effect will be to increase dramatically the displacement of channels from the edges of the licensees' blocks and thus the number of channels within a block. This, in turn, could lead to major reductions in capacity and the quality of the communications as perceived by the end user. Another effect would be an increase in equipment costs. For portable devices, the increase in equipment costs will be manifest in the use of far more linear and higher current drain amplifier designs, which will mean shorter talk times or significantly larger devices (due to larger batteries).

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<sup>1</sup> The reference to 80 decibels is shown as deleted because this would imply a 5000 watt transmitter output, an impossibility given the 100 watt transmitter output power limit in the rules.

## UNLICENSED PCS

As modified in the MO&O, Section 15.323(c)(6) specifies a randomly chosen waiting interval between 10 and 150 milliseconds for isochronous devices when a combined time and spectrum window is unavailable. However, it is not certain whether the random waiting interval applies to a device transmitting in the combined time and spectrum window; i.e., the device making the window unavailable, if the device ceases transmission and re-accesses the same window. Motorola recommends the paragraph be clarified to read as follows:

**If the selected combined time and spectrum windows are unavailable or if a device ceases transmission in a window, the device may either monitor and select a different window or seek to use the same window after waiting an amount of time randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available or at cessation of transmission.**

The above clarification will ensure that any device ceasing transmission must contend on a fair and equitable basis with other devices when re-accessing the same time and spectrum window. More specifically, it must observe the same random waiting interval as devices which are waiting to access the window. Without this clarification, a device may cease transmission, monitor for only 10 milliseconds, and resume transmissions. If so, other waiting devices would not have fair access to the spectrum. Indeed, devices observing the 10 to 150 millisecond rule would have less than a 7 percent chance (10/150) of accessing the window whereas the original transmitting device has a 100% chance to re-access. Even if the device in queue chose a 10 millisecond waiting time, it would likely collide with the original transmitting device. More importantly, the device in queue has no opportunity to access the window prior to the original transmitting device and the original transmitting device need not ever relinquish the window.

This clarification is important to support the intent of several other rules as well. The one second time limit for unacknowledged transmissions could be circumvented by a device if it is not required to contend on an equal basis with other devices for re-access. The same is true for the 30 second time limit for periodic acknowledgements after initial acknowledgement and the 8 hour time limit for occupation of a window by a device or group of cooperating devices. Failure to apply the random waiting interval rule when a device ceases transmission would permit monopolization of a time and spectrum window to the detriment of the rules cited above.

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Please let us know if any of these clarifications or interpretations require further discussion. Motorola looks forward to working with you and the rest of the FCC staff to ensure that PCS becomes a technical success providing the American public with real communications options.

Sincerely,

*Stu Overby/psn*

Stu Overby  
Assistant Director  
Spectrum Planning  
Motorola, Inc.

*David E. Hilliard*

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of  
Wiley, Rein & Fielding  
Counsel for Motorola, Inc.

cc: Mr. Richard Engelman  
Mr. John Reed  
Mr. Phillip Inglis  
Mr. William Caton (2 copies)